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RPPR Final Report
as of 08-Feb-2018

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Accomplishments: Nothing to Report

Training Opportunities: Nothing to Report

Results Dissemination: Nothing to Report

Honors and Awards: Nothing to Report

Protocol Activity Status:

Technology Transfer: Nothing to Report

PARTICIPANTS:

Participant Type: PD/PI

Participant: Luis Bettencourt

Person Months Worked: 1.00

Project Contribution:

International Collaboration:

International Travel:

National Academy Member: N

Other Collaborators:

Funding Support:

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Journal: Scientific Reports

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Article Title: Professional Diversity and the Productivity of Cities

Authors:

Keywords: statistical physics, theoretical ecology, sustainability, socioeconomic scenarios

Abstract: Attempts to understand the relationship between diversity, productivity and scale have remained limited due to the scheme-dependent nature of the taxonomies describing complex systems. We analyze the diversity of US metropolitan areas in terms of profession diversity and employment to show how this frequency distribution takes a universal scale-invariant form, common to all cities, in the limit of infinite resolution of occupational taxonomies. We show that this limit is obtained under general conditions that follow from the analysis of the variation of the occupational frequency across taxonomies at different resolutions in a way analogous to finite-size scaling in statistical physical systems. We propose a theoretical framework that derives the form and parameters of the limiting distribution of professions based on the appearance, in urban social networks, of new occupations as the result of specialization and coordination of labor. By deriving classification scheme-independent meas

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Journal: Big Data

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Article Title: The Uses of Big Data in Cities

Authors:

Keywords: Socioeconomic scenarios, sustainability, theoretical ecology, statistical physics

Abstract: There is much enthusiasm currently about the possibilities created by new and more extensive sources of data to better understand and manage cities. Here, I explore how big data can be useful in urban planning by formalizing the planning process as a general computational problem. I show that, under general conditions, new sources of data coordinated with urban policy can be applied following fundamental principles of engineering to achieve new solutions to important age-old urban problems. I also show that comprehensive urban planning is computationally intractable (i.e., practically impossible) in large cities, regardless of the amounts of data available. This dilemma between the need for planning and coordination and its impossibility in detail is resolved by the recognition that cities are first and foremost self-organizing social networks embedded in space and enabled by urban infrastructure and services. As such, the primary role of big data in cities is to facilitate information

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Article Title: The Scaling of Human Interactions with City Size

Authors:

Keywords: networks, mobile phone data, human interactions, urban scaling, epidemiology

Abstract: The size of cities is known to play a fundamental role in social and economic life. Yet, its relation to the structure of the underlying network of human interactions has not been investigated empirically in detail. In this paper, we map society-wide communication networks to the urban areas of two European countries. We show that both the total number of contacts and the total communication activity grow superlinearly with city population size, according to well-defined scaling relations and resulting from a multiplicative increase that affects most citizens. Perhaps surprisingly, however, the probability that an individual's contacts are also connected with each other remains largely unaffected. These empirical results predict a systematic and scale-invariant acceleration of interaction-based spreading phenomena as cities get bigger, which is numerically confirmed by applying epidemiological models to the studied networks. Our findings should provide a microscopic basis towards under

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Article Title: Determinants of the Pace of Global Innovation in Energy Technologies

Authors:

Keywords: climate change, innovations in energy technologies

Abstract: Understanding the factors driving innovation in energy technologies is of critical importance to mitigating climate change and addressing other energy-related global challenges. Low levels of innovation, measured in terms of energy patent filings, were noted in the 1980s and 90s as an issue of concern and were attributed to limited investment in public and private research and development (R&D). Here we build a comprehensive global database of energy patents covering the period 1970–2009, which is unique in its temporal and geographical scope. Analysis of the data reveals a recent, marked departure from historical trends. A sharp increase in rates of patenting has occurred over the last decade, particularly in renewable technologies, despite continued low levels of R&D funding. To solve the puzzle of fast innovation despite modest R& increases, we develop a model that explains the nonlinear response observed in the empirical data of technological innovation to various types of investme

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Nothing to Report